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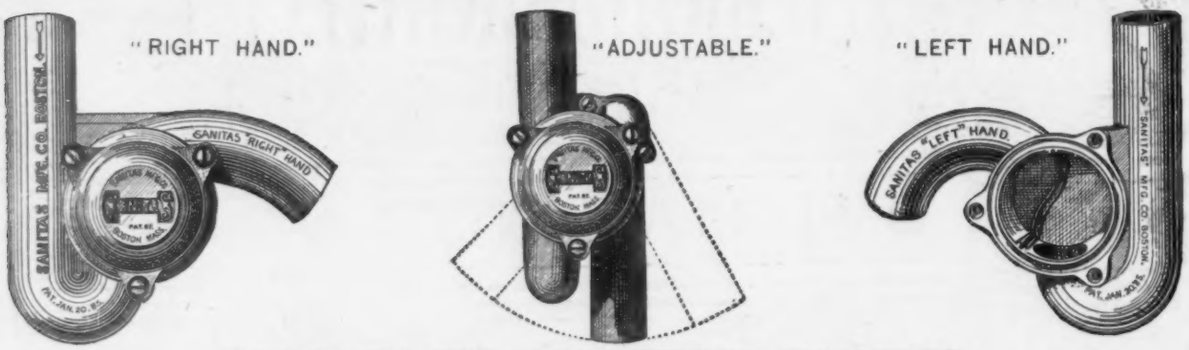
The Interior of the Bardo, Tunis.

THE SANITAS TRAP.



SOME FACTS AND SOME FANCIES
ABOUT THE SANITAS TRAP.

I. It is sometimes asserted that the seal of the Sanitas Trap can never be broken under any conditions. This is erroneous. Its seal can be pumped out by a force-pump, or by *Laboratory plumbing apparatus*, especially devised to destroy the seals of traps by siphonage. But the seal of the unvented Sanitas Trap *never can be and never has been destroyed by siphonage in good plumbing work*. Furthermore, the unvented Sanitas Trap will stand a severer test of siphoning action than will the vented S-trap. This has been demonstrated over and over again, and the demonstration can be repeated at any time to the satisfaction of any who are interested, provided care be taken to vent the S-trap in a manner *which is practical in plumbing*, using a vent-pipe of the size, length, and average number of bends found in ordinary practice. The seal of the Sanitas Trap will be *lowered* by severe siphoning action, *but it cannot be broken*. II. Again it is sometimes asserted that the Sanitas Trap cannot be clogged. This is also erroneous. The trap can be clogged by matches or kitchen refuse, if improperly used, just as can any ordinary waste-pipe; but when properly set and used the Sanitas Trap will never become clogged to the point of losing its effectiveness. If improperly used, as when under kitchen sinks the cook takes out the sink-strainer and sweeps into the trap bones and refuse never intended for the waste-pipe, the Sanitas Trap will be fouled; but it then *has the great advantage over all others of providing the easiest and safest means of removing this refuse matter*, and that with the aid of an ordinary screw-driver. When used under sinks the trap should be placed close to the sink outlet, and the sink strainer should never be removed. The grease will then pass through the trap in a liquid state and be caught in the suitable grease receptacle beyond. The efficiency of the Sanitas Trap will then remain intact indefinitely, while other traps, like the old-fashoned "D" trap, or its modern representatives, the "Bottle," "Round," and "Pot" traps, have bodies so much larger than their inlet and outlet arms, that they obviously cannot be scoured by the water when it passes through them. III. It is often thought that where special trap vent-pipes are called for, the Sanitas Trap is not needed. Precisely the opposite is the fact. All sanitarians now admit that whether the trap vent-pipe be used or not, *the trap itself should be anti-siphonic*, since the vent alone cannot always be relied upon. The mouth of the vent-pipe is often clogged, under sinks, by grease, since it is never scoured, and the friction due to its bends, and to the disproportion between its capacity and its length, often destroys its efficiency as an air supply. The Sanitas Trap is so constructed that its seal cannot be injured by evaporation produced by trap venting. Therefore, *where trap-vent pipes are called for the use of the Sanitas Trap is particularly necessary.* In virtue of the peculiar construction of the Sanitas Trap, *its outlet-pipe forms its own vent-pipe*, which is infinitely better than a special vent-pipe, inasmuch as it is always kept open by the scouring action of its own discharges. But even if it should ever become closed by grease, no harm could come in this case, since the same closure would not only shut off sewer-gas and siphonage, but also at once announce itself and be removed. IV. Finally, the seal of this trap can never be destroyed by *back-pressure*, in properly arranged plumbing. For with the main soil-pipe vented as it should be, no back-pressure can be generated strong enough to do mischief, where ordinary care and intelligence are used in originally laying out the work. For further explanations on this matter see the circulars and other publications of the

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IT is a satisfaction to find that the Americans are certainly giving lessons to the rest of the world in matters of construction, if not of art. Perhaps the art will come later. Not long ago a great fire took place in Berlin, totally destroying a structure composed wholly of brick and iron, and built with the solidity characteristic of German work. The building was a storage-warehouse for the great Berlin express company, and was about a hundred feet wide, and a hundred and fifty long, six stories high, with a small court-yard in the centre. A heavy brick wall divided it through the middle, and the floors were all made with brick arches, turned between iron beams, which rested on the walls, and on ranges of iron girders, supported by cast-iron columns. The doors in the partition-wall were of plate-iron. We have learned by experience the vulnerable points of such a structure, but to the Germans, unaccustomed to destructive fires, it must have seemed as fireproof as it would have to us thirty years ago. Five months after the building was substantially completed, one or two temporary openings were made in the third story floor, for the purpose of finishing some part of the work, and while these were still open, an accident occurred, by which fire was set to some goods stored in the third story. The flaming brands immediately fell through the holes in the floor, setting fire to the goods in the next story below, which were mostly cotton and woollen materials, and although the fire-engines arrived in five minutes after the fire started, they were too late to be of any service. Five minutes seems a short time for a fire starting in a little bundle of dry goods to accomplish the destruction of a huge building, in the construction of which there was not a trace of inflammable material, but no sooner had the nearest bales become kindled than the iron beams over them, quickly heated by the flames, expanded, violently wrenching the girders, and in many cases breaking off the capitals of the columns. In this effort the beams themselves were bent and twisted, letting the brick floor-arches fall; and so quickly did this effect occur that many of the floor-arches had fallen out before the engines arrived, five minutes from the setting of the fire. The collapse of the arches not only opened a passage upward for the flames, but piled broken cases, torn cloth and other combustibles, in the best condition for speedy kindling, upon the blazing goods beneath, and the west half of the structure, in which the fire first caught, was soon a mass of flames. The eastern half was cut off by means of the iron doors, all of which had been duly closed, but these soon became red-hot from the action of the fire behind them, and in that way set fire to goods lying against them, and they also soon warped enough to let the flames through, and hasten the effect, so that in one hour from the first alarm little remained of the western half of the building but the tottering outside walls, a large portion of which had already fallen, while the three upper stories of the eastern half, notwithstanding the brick partition wall and the iron doors, were totally destroyed, and the lower stories nearly ruined by the fall of the upper floor-arches. On examining the place after the fire, it was found that out of one hundred columns which originally held the floors, thirty-eight had been thrown completely out of their places, while thirty-four more, although they remained standing, were so broken or bent as to be useless, the only ones still fit for service being those in the lower stories of the eastern half of the building. The girders were formed of iron beams, eighteen inches deep, and these were in some places twisted like corkscrews by the strain which they had undergone. An expert commission was immediately appointed to study into the causes of the fire, and made a report expressing the opinion that no building could henceforth be considered fireproof unless the flanges of iron beams, and all portions of iron columns, were "covered by some non-conducting material," as "is now commonly done in such structures in the great cities of the United States of America."

MR. JOHN C. COCHRANE, of Chicago, an architect of high reputation all over the country, died last month at his residence, after a short illness. Mr. Cochrane was born in New Hampshire in 1833, and, after completing his education, removed first to Chicago, and then to Davenport, Iowa, where he entered upon a very successful practice. In 1864 he returned to Chicago, and has been prominent in professional matters in that city ever since. His best-known building is the Chamber of Commerce, but he designed many churches and private dwellings, showing a refinement of taste which, at the time when he first began his work, was particularly valuable in the West. He will be greatly missed in the profession and in society in a large part of the West.

BOTH the *Builder* and the *British Architect* have of late had a good deal to say about the uniform rate of commission which is maintained among architects all over the world. To them, as, indeed, to a great many thoughtful persons in the profession, there seems to be a good deal that is objectionable in a rate of compensation which is the same for the consummate artist as for the young beginner or the ignorant pretender to professional knowledge. In the interest of art, both of them think it a misfortune that a man capable of making perfect examples of architectural art should be condemned by the rule on which his compensation is based, either to disregard the beautiful ideals floating through his mind and get through his work with the same expenditure of thought that his soulless competitor next door would bestow on it, or, if he chooses to follow art for art's sake, to be obliged to do so at his own expense, since no higher remuneration is provided for the author of a beautiful building than of an ugly one. It must be confessed that there is a good deal to say on this side of the subject, but there is another side which is well presented in a letter to the *British Architect* by Mr. Basil Champneys. In this letter, although Mr. Champneys admits that the architects who study their work like true artists are very inadequately paid by a five per cent commission, and, moreover, that it is rather an anomaly that the most experienced men should be paid at the same rate as beginners, he considers, nevertheless, that there are advantages in the present system which should not be rashly given up. As to the artistic part of the work, he believes, at the outset, that this is never paid for directly at all. No matter how consummate an artist a man may be, he is paid for designing and putting up a building which is reasonably convenient and will not fall down. If he accomplishes this, he is entitled to his full fee, and the idea that if he studies its masses and proportions, refines its details and seeks inspiration for its decoration, he is entitled to be paid any more, has not as yet occurred to the public, whatever the profession may think about it. For the present, moreover, Mr. Champneys thinks that this state of things is inevitable. A time may come when the public will understand architectural art and pay for it directly, but it is now practically incapable of recognizing such art when it is offered them, and would be quite as likely to be taken in by the outcries of an advertising architectural buffoon as by the pure and deeply-felt beauty of a master's work, so that whether we wish it or not, we must content ourselves with what he calls the wholesome position, that we must do the best we can for art because we love it and not because we love money.

SIMPLY as a practical matter, however, the five per cent rule is worth holding on to until something better can be generally accepted. It is true that under it the beginner receives the same proportionate fee as his abler or wiser rival, but the beginner's commissions are usually few and of no great importance, while his experienced neighbor is kept constantly busy with work involving the expenditure of large sums, so that the latter's income, at the same percentage, is many times as great as that of the younger man. Besides this, the same rule brings about an indirect compensation for artistic capacity and study. Although the public cannot say what it likes, and is easily misled by every one with a new architectural nostrum, in the end it usually comes back to what is pretty, unassuming, and interesting, in other words, to what is artistic, and the man who tries hard and successfully to make his work artistic is generally rewarded by having plenty of employment, while the ill-trained and unfeeling designer of vulgar and commonplace buildings, although he gets as large a percentage on his commissions as the artist, has fewer of them, and will have still less as the public taste advances. The physicians, who maintain uniform rates of fees for general practice, find it advantageous to do so, the income of the abler ones being increased to their satisfaction by the greater number of their patients; yet they need to study their cases quite as much as architects do their designs, and the architects have an advantage over them, that their compensation increases with the importance as well as the number of their commissions, while physicians, unless they happen to be specialists, receive the same amount for a visit to an overfed child as to a patient in mortal extremity. Where a doctor chooses to devote himself to a certain branch, and attains recognized skill in it, he can claim a much higher rate of fees as a professed specialist, and this is already to some extent the case in architecture. The late Mr. Richardson, for example, was rarely content with five per cent commission, and found no difficulty in obtaining seven and one-half, even for buildings of great importance, and much more for many structures which young architects would be glad to undertake at the usual rate.

A SET of instructions for the planning and fitting up of public elementary schools has been published by the English Education Department. An English primary school is so completely different in nearly every respect from one of ours that the rules for planning them are of no very great value to us, but there are some interesting points. The standard width for schoolrooms is less than with us, the rules specifying eighteen to twenty feet where long desks accomodating four or more children are used, or twenty-two feet where double desks are preferred. This seems rather surprising to our notions, the long desks, or forms, having been obsolete in our schools for thirty years, while even double desks are now considered objectionable, and in the best American schools each pupil, even in the primary departments, has his tiny single desk to himself. The elasticity of the specified dimensions, again, strikes us as rather strange. If eighteen feet is wide enough for a schoolroom seated in a certain way, twenty feet must be too wide, and if twenty feet is right, a width of only eighteen must mean constant crowding and annoyance to the pupils. The convenient and comfortable dimensions of desks and aisles have with us long been settled, and the dimensions of a schoolroom are, in well-planned buildings, just such as to contain the desired number of desks and aisles, without superfluous space and without robbing any part of its standard dimensions. In regard to the height of rooms, the English code seems to have borrowed something from the recent French and German rules, and demands that all school and class rooms shall be at least twelve feet high from floor to ceiling, provided the area does not exceed three hundred and sixty superficial feet. If the area is between this and six hundred feet, the height must be thirteen feet, and if larger than this, it must be fourteen feet as a minimum, no maximum being specified. If a schoolroom is ceiled on the collar-beam and lower part of the rafters, the distance from the floor to the wall-plate must be at least eleven feet and to the collar-beam three feet more. Roofs open inside to the ridge are not favored, and, if used, must be ventilated from the ridge and covered with impervious material.

SOME of our readers may remember Signor Boni's account of the Fondaco dei Turchi, published in November, 1885. One front of this building was restored some years ago, but the other has remained until recently in the condition in which it was put after it was abandoned as a public resort, and its arcades bricked up to fit it for a place of storage, and is well known to architects by photographs, either under its own name or the absurd one which is often given it by the foreign photographers of the "Palace of Lucretia Borgia," the fact being that if this lady ever saw it at all, which is by no means certain, it must have been at least five hundred years old, and in a state of disrepair highly unsuitable to the dwelling of a cardinal's daughter. As a result of the passion for polishing up and repairing old buildings, which is just now very prevalent in Venice, the remaining front of the Fondaco dei Turchi has just been restored with such thoroughness that, as Signor Boni says, there is no longer any hope "of finding any part, even the smallest, which we may look upon with confidence as a relic of the ancient palace." As the restored front was much the more interesting of the two, its restoration is certainly a loss to picturesque architecture, and the remains of the Venetian Byzantine are now so few in number that it seems a pity to have any of them falsified by the restorer's chisel and scraper.

AMONG the good things accomplished by the Congress for the Advancement of Technical Education which met at Bordeaux last year one of the best was the public notice, given in an excellent report, presented for the commercial section by Mr. Merckling, of the importance of the schools for commercial education which are now in operation in many places on the Continent. In Germany, the leader of all countries in most matters of education, the first thought of those who see a prospect open for the development of a new industry is to prepare a course of instruction intended to fit persons for pursuing the new employment with advantage, and the result of the Imperial policy of extending German influence, wherever possible, in all parts of the world, has been to create a great demand for schools in which young men, as a preparation for employment in the new commercial enterprises, can learn book-keeping, the principles of finance, and commercial law, besides such foreign languages as will be most useful in an extended business, and the details of certain branches of manufacturing, if manufactured goods are likely to occupy an important place in the future merchants' affairs. In response to the demand, such schools or courses of instruction have sprung up everywhere, and the consequence is that as the German manufacturers, through their enterprise in establishing technical schools, have succeeded in making themselves first in the markets of the world, and even sell their goods in immense quantities to the French, their chief competitors, so the German merchants' clerks, equipped with the training of their new schools, find their way to profitable employment all over the world, and are met with in great numbers in England, where their business-like habits, and their usefulness in the foreign trade which forms a large part of the affairs of most great English merchants, gives them an immense advantage over the native clerks. Following the example of the Germans, the French have, in a quiet way, done much recently to promote commercial education, and schools for the purpose of providing such education have been established at Paris, Lyons, Marseilles, Havre and Bordeaux, while prizes, in the shape of scholarships for foreign travel, are offered by the Government to the most industrious and successful pupils. A new experiment has also been tried in France, in the opening of education of this kind to girls, Lyons having a commercial school for girls, as well as one for boys, while in Paris the great municipal school for girls has a commercial section. Considering how large a part of French retail business is carried on by women, it is certainly desirable in every way that the same opportunities for preparing themselves to manage it successfully should be open to them as to the other sex, and the Congress adjourned with a special recommendation of the girls' commercial schools to the attention of the public, and the wish that other cities might follow the example of Paris and Lyons. Before the next meeting of the Congress, which is to be held in St. Petersburg in 1888, it would be interesting to collect information in regard to our own commercial schools and business colleges, to which both sexes in this country owe so much. In some respects their curriculum is very limited in comparison with that of the German schools; but our clerks and salesmen have little use for foreign languages, and the best of our business colleges teach what they undertake to impart with remarkable success.

OPEN-TIMBER ROOFS OF THE MIDDLE AGES.—I.

"All architecture is but a glorified roof." — *Ruskin.*

"There are few features of Mediæval art in this country to which attention could be more profitably directed than the roof; for, whether applied to secular or ecclesiastical buildings, the framed and carved wooden roof is essentially English in execution and application, and is one of the most beautiful and appropriate manifestations of our national art." — *Fergusson.*

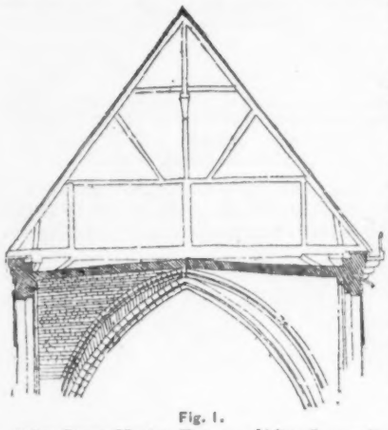


Fig. 1.
Nôtre Dame, Mantes, France. [After Jo nson's "*Specimens of Early French Architecture.*"]

THE builders of the Middle Ages have left us many proofs of their skill, but none more interesting than those revealed by a study of their open-timber roofs. Certainly it is in these if anywhere that the Mediæval architects succeeded in doing what they have always been credited with doing, namely, boldly recognizing and accepting forms imposed by the exigencies of construction, and then, by artistic decoration, endeavoring to render them beautiful and harmonious. In this respect these roofs afford excellent examples of successful applications of the principle of "ornamental construction."

In design these roofs were not always scientific, but in execution they were invariably excellent. In the earlier periods it must be admitted that much was done that cannot be admired either from a constructive or an artistic point of view. It may be said of these unsuccessful efforts, however, that they are of exceeding interest as showing the many difficulties encountered and overcome, and thus, when contrasted with the beautiful works of later times, serve not to detract from but rather to heighten our admiration for those remarkable specimens of Mediæval art.

To-day, practical questions, such as expense, acoustic properties, etc., tend to prevent anything like general use as in the period of Gothic Revival, but it is still to be said that "no form of wooden covering is so good in the internal effect as the high-pitched, open roof with its massive timbers crossing and recrossing in perspective and giving mysterious shadows and half lights above." [1]

ABSENCE OF EARLY EXAMPLES.

A very noticeable feature in the history of wooden roofs is the absence of early examples, especially on the Continent. The number of examples previous to the fourteenth century is surprisingly small, though, considering the perishable nature of the material, it might be urged that the existence of any examples, not the lack of many, should occasion surprise. The existence of so few examples may be accounted for in several ways. It is largely due, of course, to the inflammable nature of the material. Though time and decay were not without their effects, fire was a far more destructive agent. One needs but to read the early history of the great cathedrals to learn how frequent and disastrous were the conflagrations of those days. The labor of years was often lost in as many hours. A material with which this was not only possible but even probable, naturally came to be held in more or less contempt. Moreover, this prejudice against timber construction was, no doubt, encouraged by that great body of workers in stone, the Freemasons. Thus, not only were many specimens actually destroyed, but also many others were not erected because of their liability to such destruction. On the Continent, except in Normandy, it is found that stone vaults were mostly used, wooden roofs being merely for the protection of vaulted ceilings, and composed of large, roughly-squared timbers, which were framed for the work they had to do without regard to their appearance (Fig. 1).

SUPERIORITY OF ENGLISH ROOFS.

In Normandy, as just intimated, wooden roofs did not give way to stone vaults to the same extent that they did in other parts of the Continent. As early as the eleventh century the Normans had made considerable progress in the construction of timber roofs. Taken in connection with several others, this fact is of considerable significance. Why is it, for instance, that timber construction received more attention in Normandy than elsewhere on the Continent? Why is it that the English roofs should be so vastly superior to those of the Continent, in fact, being unsurpassed for variety, richness and beauty? An explanation is to be found in the fact that the race origin of the English and Normans is the same and is altogether different from that of the French. Moreover, the original Normans or Northmen were a great sea-faring people, a nation of sailors and ship-builders. Now, before the Iron Age to be a nation of ship-builders was to be a nation of carpenters. The original Britons were Northmen — Angles, Saxons, Jutes. After the death of Alfred, England was conquered by the Danes or Norsemen, and shortly afterward came the Norman Conquest. The English, thus having the same race origin as the people of Normandy, naturally had the same race characteristics. Moreover, the insular position of the English was not without its influence on their national character. The English were thus a carpentering people, and to this element of their character it is easy to ascribe their superiority in timber construction to the French, who inherited no such national trend of mind.

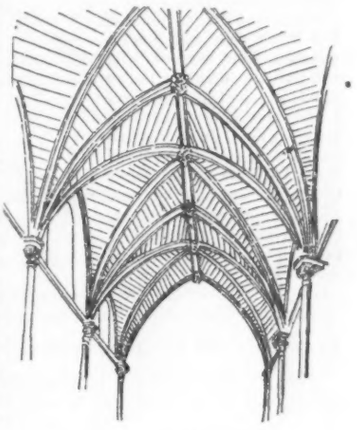


Fig. 2.
Wooden Groined Roof, Warmington, England, (1260). [After Rickman's "*English Architectural Styles.*"]

This explanation finds confirmation in the history of English Gothic architecture, a singular feature in the development of which is the constant progress from the forms of masonry to those of carpentry. The whole course of English vaulting is in fact a gradual approximation to panelling, which is essentially a characteristic treatment of wood. Fan-vaulting is quite as easily executed in wood as in stone. An example of a wooden groin vault is given in Figure 2. Such a result certainly bespeaks a carpentering turn of mind. The development of *English* open-timber roofs will, therefore, be the subject for detailed consideration, the French examples receiving merely incidental attention as they serve to illustrate intermediate steps.

WOODEN ROOFS OF ANTIQUITY.

Before taking up the English roofs, however, it will be worth while, perhaps, to briefly consider what had been done in this direction previous to the Mediæval period. The earliest and simplest form of wooden roof is that known as the tie-beam. In this form of roof (Fig. 3), two inclined rafters are framed together at the top, while they are held together below by a horizontal beam, called the tie-beam, which serves to counteract the tendency of the rafters to spread apart below and exert an outward thrust on the walls.

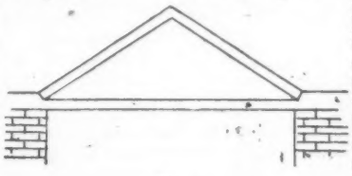


Fig. 3.

Very little is known about wooden roofs as used by the ancients: no examples, of course, remain, but, though it has been held on this account that they had none, it is probable that they were of this simple tie-beam description. There is no evidence of progress in the construction of timber roofs until the later days of the Roman Empire. Vaults were then erected that required centres of no mean construction, and basilicas were built which required roofs of large

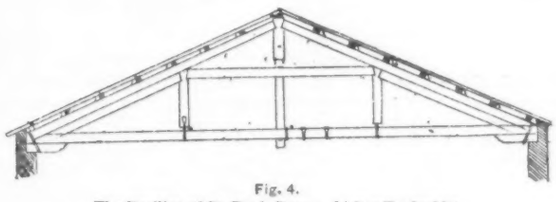


Fig. 4.
The Basilica of St. Paul, Rome. [After Tredgold.]

span. The Ulpian basilica is considered a typical specimen of those with wooden roofs. This was one hundred and eighty feet wide and

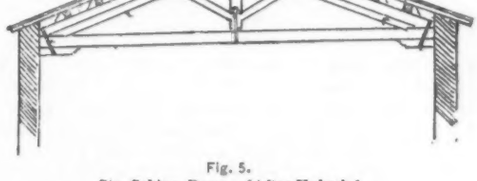


Fig. 5.
Ste. Sabine, Rome. [After Hubsch.]

divided into five aisles. The central one, nearly ninety feet wide, was covered with a wooden roof of semi-circular form.[2] Built largely

[1] From an article on the "Architectural Treatment of the Roof," *Builder*, December 16, 1876.

[2] A restored section of this basilica is to be found on page 317, Vol. 1 (Fergusson).

after Roman models, the wooden roofs of the Early Christian basilicas may fairly be taken as representing Roman forms and methods. The common forms, king and queen post trusses, are shown in the accompanying figures, viz., 4, 5, 6 and 7.

These examples show just about how far the construction of timber roofs had advanced before the Middle Ages. It is evident that the principle of the truss was well understood. The use of iron straps, bolts, etc., which are not found in the Mediæval roofs, was almost necessitated by the enormous spans which were covered, some of these being twice the width of the average Gothic nave. Moreover, in most instances, these roofs were intended to support a flat ceiling, which, besides bringing additional weight on the trusses, concealed them, and consequently no attempt was made at artistic design or decoration.

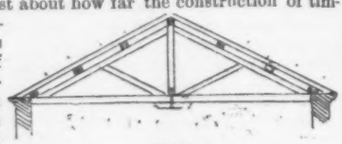


Fig. 6.

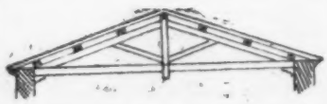


Fig. 7.
S. Lorenzo *extra Muros*, Rome. [Hubsch.]

CLASSIFICATION AND DESCRIPTION OF ENGLISH TIMBER ROOFS.

The different varieties of English open-timber roofs may be arranged in the order of their development as follows:

A. Tie-beam Roofs. { Trussed.[1] — Single Frame. / Untrussed. — Double Frame.

B. Roofs without Tie-beams:
1. Trussed Rafter. — Untrussed. — Single Frame.
2. Hammer-Beam. } Trussed. — Double Frame.
3. Collar-braced. }

Another classification would be this:
(*a*) Roofs from which the thrust or pressure is vertical.
(*b*) Roofs from which the thrust or pressure is oblique.

(*a*) and (*b*) of the latter correspond to (*A*) and (*B*) of the former classification. Practically, everything except the tie-beam roof comes in the second class (*b*) unless an exception is made of the low-pitch roof of the late Perpendicular period, the thrust of which was approximately vertical.

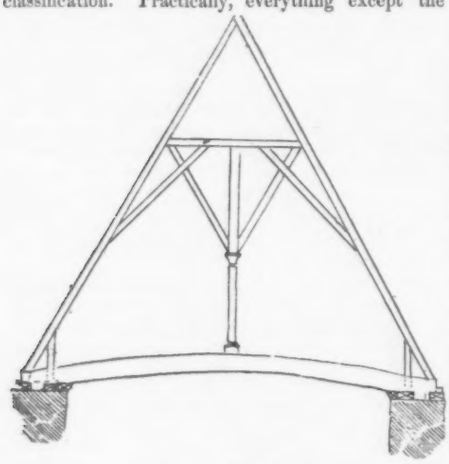


Fig. 8.
[Viollet-le-Duc.]

(*A*) *Tie-Beam Roofs.* — The science of trussing which had been so successfully applied by the Romans was lost during the Dark Ages. In the theoretically perfect truss, the load should produce no transverse strain on any part, and the pressure transmitted to the abutments should be vertical. These two essential principles of the truss are not recognized in the early Mediæval roof. The real functions of the king-post and tie-beam are often wholly misconceived. For example, the king-post is frequently found as an upright strut supported by the tie-beam (Figs. 8 and 9).

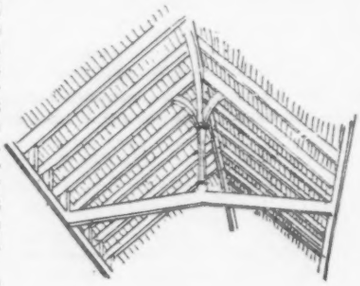


Fig. 9.
Swardstone Church, England. [Brandon.]

The primitive form of Mediæval roof, according to Viollet-le-Duc, was a simple one of the tie-beam form with a short collar-beam introduced near the apex (Fig. 10). Occasionally a short king-post was used. For small spans this served very well, but the moment the span was increased to any extent, the tie-beam had a tendency to sag. This sagging was prevented in the first instance by making the tie-beam of very large dimensions. The massiveness so characteristic of all early roofs is sometimes attributed to the abundance of material at hand, but it would seem to have been quite as much the result of methods of design then in vogue. In the course of time this tendency to deflection on the part of the tie-beam became the source of much difficulty and resulted finally in the introduction of the king-post as a tie (Fig. 11).

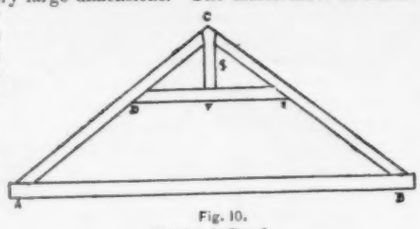


Fig. 10.
[Viollet-le-Duc.]

The first attempt to brace the rafters was decidedly unsatisfactory.

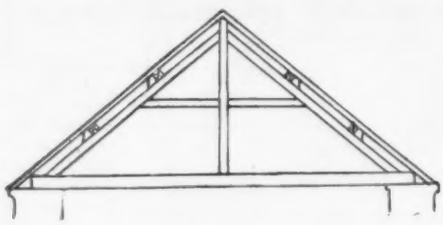


Fig. 11.
[Viollet-le-Duc.]

The manner in which this was accomplished is shown in Figure 12. The curved struts which were introduced to stiffen the rafters were themselves supported by the tie-beam. Additional strength was given to the rafters, but it was secured at the expense of the tie-beam. It was not long, however, before this method was abandoned and a better one devised. By simply reversing the position of the struts and framing them into the king-post instead of the tie-beam, a transverse strain was converted into a tensile one and a scientifically-constructed truss was obtained (Fig. 13).

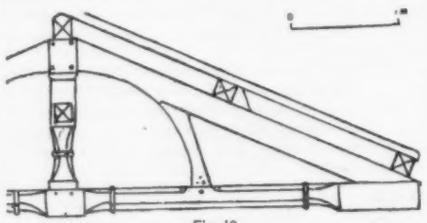


Fig. 12.
[Viollet-le-Duc.]

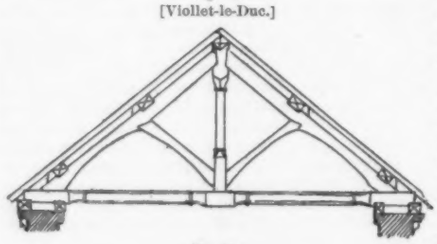


Fig. 13.
[Viollet-le-Duc.]

Most of these roofs were double-framed, that is to say, composed of two sets of rafters. The "common" rafters, which received the roofing material, rested on a framing of "purlins" that was supported at regular intervals by heavy trusses, made up of a pair of large rafters known as "principals." Such a method of construction made the roofs very heavy and necessitated the use of very thick walls, not only to support the weight, but also to give a proper bearing for the tie-beam and principals. A device for obviating this excessive thickness of wall, first found in France, was to sink the

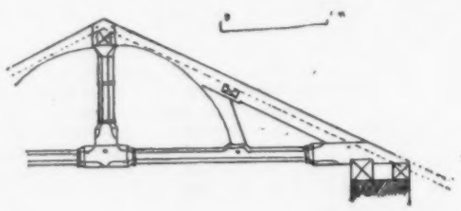


Fig. 14.
[Viollet-le-Duc.]

purlins into the plane of the "principal" as shown in Figure 14. Another method, which also came into general use, was to increase the pitch of the roof. It was seen that as the pitch of the roof was increased the amount of transverse strain in the rafters was dimin-

[1] Every roof is trussed. Either every pair of common rafters is trussed or only a few larger ones, called principals, but only is a roof technically said to be trussed in the latter case when it is supported at intervals by a pair of large rafters ("principals") which are strongly tied and braced. The bays or spaces between these "trusses" are spanned by smaller ("common") rafters.

ished, and the less transverse strain there had to be provided for, the smaller the timbers and the lighter the framing could be.

Two methods of stiffening the rafters and at the same time lessening their effective thrust on the walls merit attention. One effect of increasing the inclination of the roof was to increase the vertical distance from the inner edge of the top of the wall to the under side of the rafter (*a*, Fig. 15). By inserting a vertical strut here and framing the lower ends of both strut and rafter into a horizontal shoe

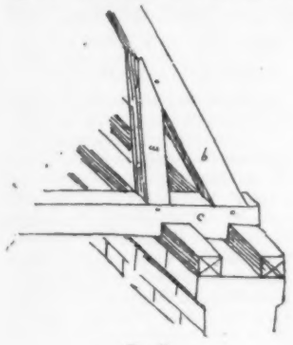


Fig. 15.

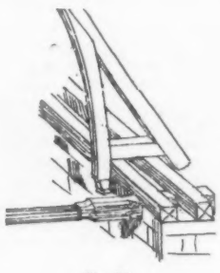


Fig. 16.

[Viollet-le-Duc.]

(*c*, Fig. 15), not only was greater stiffness given to the rafter, but its thrust was made more nearly vertical. The shoe (*c*) was sometimes made the end of the tie-beam.

When short and separate, as in Figure 17, the tie-beam was raised or arranged as in Figure 16. Both of these examples (15 and 16) are French. That shown in Figure 17 is English and differs only in the method of fixing the shoe-piece to the wall. In England, the tie-beam roof was never used to any extent, and even when it was, the proper function of the tie-beam seems to have been misapprehended. It was generally made quite independent of the other timbers; it was really nothing but a heavy beam laid across from wall to wall and used as a sort of foundation from which to build the roof. To prevent the deflection which such usage would develop, the beam had to be made of very large section. In effect this was very heavy and depressing, and so, as Mr. Street says, "the old architects were constantly varying their designs with the object of improving the construction of their roofs and very often with a view to dispensing with the tie-beam, which in many cases was felt to be an eye-sore." For example, it was almost invariably cambered in order to prevent any appearance of sagging, which is the case with a perfectly straight tie-beam (Figs. 8 and 9), and accordingly the latter is of rare occurrence. As a further means of overcoming this disagreeable effect, curved braces were often introduced (Fig. 18).

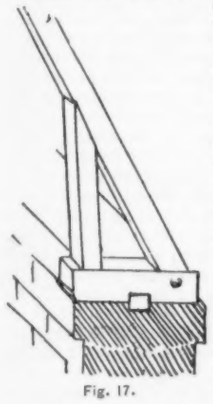


Fig. 17.

Fig. 18.
Outwell Church, England. [Brandon.]

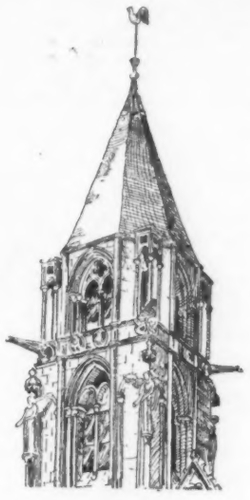
Tie-beam roofs of very low pitch were used in the Perpendicular period. Frequently the pitch is so low that it is obtained by merely cambering the tie-beam. The tie-beam roof has no disturbing effect on the substructure and is simple in its construction. For utilitarian purposes, it is the best form and probably the most economical. "It can scarcely be considered as conducive to architectural effect, however. This is obtained when the tie-beam is dropped and the roof may be said to spring from, not merely rest on the walls. The structure then becomes a complete whole; walls and roof are dependent on one another; the roof becomes a part of the architecture, not a mere covering laid on."[1]

[To be continued.]

If our readers have wasted half as much time as we have in trying to find some definite illustration which we know was published in this Journal at some indefinite past time, they will be glad to know that the Decennial *Index of Illustrations in the American Architect* is now ready in book form.

[1] From an article on "Architectural Treatment of the Roof." — *Builder*, 1876.

THE THIRD EXHIBITION OF THE ARCHITECTURAL LEAGUE.



THE third of the annual exhibitions of architectural drawing which have, fortunately for the profession, been carried out by the energy of the New York Architectural League, is to be found in new and very pleasant quarters on the ground floor of the new building on Fifth Avenue, between the Stewart Mansion and the Caswell House, the old University Club, which has just been erected for the use of a few artists and a well-known firm of picture-dealers. Although not quite so brilliantly illuminated by day as the old galleries on Twenty-third Street, thelight is pleasanter, and the arrangement of the rooms better adapted to give effect to the collection. Under these favorable circumstances the exhibition presents an appearance which we may well call remarkable, and in the brilliancy and variety of the drawings shown, the skill with which they are arranged, and the piquant interest of many of the delightful designs, the New York collection far surpasses the architectural portion of the Royal Academy exhibition in London or that of the *Salon* in Paris. Not long ago one of the English professional journals warned its British readers that their American cousins had nothing to learn from them in respect to clever sketching, and that if they did not look to their laurels, they would see them transferred across the water, and the exhibition of the present year certainly indicates that the Americans mean to get a good place when the start in the artistic race is made.

As compared with the exhibitions of previous years, the present one is, as a whole, agreeably marked by the absence of those obtrusive, elaborate and depressing colored drawings, in which a painter has done his best to infuse interest into a commonplace design, which not long ago formed the staple of such collections, and the unquestionable tendency, which this fact indicates, of the younger architects to draw and render their designs themselves, is full of promise for the future of their art. It is true that they are not always very successful in their renderings, and many consumptive, raw and sprawly sketches mingle with the others, but an architect learns more and advances faster by making a bad drawing of his own design than by "directing" the efforts of the most accomplished artists in the evolution of his idea.

To begin at the beginning, the catalogue of the exhibition is this year a little treasure, free from the grotesque proof-reading which characterized the former ones, exquisitely printed and illustrated, and bound and arranged with perfect taste. A large part of it is given up to advertisements, but it is none the worse for that, and the finances of the League are considerably better, so much so, in fact, that the continuance of the yearly exhibitions is, we understand, assured, through the success of the catalogue, in lightening the burden of expense which they entail. If we might make a suggestion which would make the next year's catalogue perfect, it would be that the illustrations should comprise a few reproductions of such beautiful decorative works as the committee was this year fortunate enough to secure.

The most conspicuous drawings to be seen in the vicinity of the entrance-door are those made by Mr. Joseph Pennell for the *Century* Company, to illustrate Mrs. Van Rensselaer's papers on the English Cathedrals. With most of the visitors these seem to be the favorites of all the drawings in the room, and they are indeed masterly, but we must confess that we did not find them quite as interesting as we expected. Some are in India-ink wash and some in pen-and-ink, the latter, which are splendidly executed, and in some portions show a good deal of that delicious tenderness which we have learned to prize so highly in Mr. Pennell's smaller works, being, to our mind, preferable to the washed drawings which have an uncomfortable air of having been drawn from photographs. Besides the main group of these, others are, with a clever purpose of relief by their broad black and white surfaces, scattered among the smaller sketches in various parts of the room. A considerable part of the colored drawings and, of course, many of the best, are by Mr. Louis C. Tiffany, whose clever sketches from nature form brilliant spots over the best-lighted wall. Next to some of these, which follow the large Pennell group, the most interesting drawing is a pen-and-ink sketch of a Romanesque doorway, executed, we think, for a Chicago club-house by Messrs. Burnham & Root. This is reproduced in the catalogue, and has already been given in the *Inland Architect* and copied in the London *Builder*, and, as a design, no less than as a masterly drawing, well deserves the high praise bestowed upon it by the editor of the *Builder*. Near this is a clever sketch of a proposed alteration by Mr. James Brown Lord, drawn by Mr. T. Rockwood Cutler in body

color, with a little transparent color in the shadows and clouds, on rough brown paper. Although very sketchy, the bare paper showing through in many places, the lines are firmly put in, so that there is no uncertainty as to the forms intended and the effect is excellent. In No. 46, near by, Mr. William Convers Hazlett gives a pretty pen-and-ink drawing, somewhat in Mr. Wright's manner, of a country house. This is one of several by the same architect, who is comparatively a new contributor to professional exhibitions, but who is honored, and justly, by having two of his works in the present one reproduced in the catalogue.

We look rather eagerly for specimens of the work of Messrs. Rossiter & Wright, and are happy enough to find several, some drawn by Mr. Wright, and others by Mr. Rossiter. It is needless to say that all are strikingly pretty, both in design and drawing, but we look with confidence to find some special treasure among them, and find it in a colored sketch, No. 129, of a house in Connecticut, by Mr. Rossiter. Such drawings as these of Mr. Rossiter's and Mr. Cutler's seem to us nearly the perfection of architectural sketches in color. More finished drawings, unless of large buildings, are apt to sacrifice either the architecture to the color, or *vice-versa*, and less finished ones often leave the architecture so indeterminate as to come barely under the head of architectural drawings at all. Among the impressionist works of this sort in the exhibition, the most conspicuous are perhaps some drawn by Mr. Clarence S. Luce, either for himself or Mr. George Martin Huss. It is needless to say that all these are pretty and taking at a distance, but on closer examination the design appears wanting. Some lines are there, not always tending to an accurate vanishing point, but they are far between, and might mean almost anything. This is the more disappointing, as all Mr. Luce's lines are precious, and one does not wish to see them economized.

We have, unfortunately, only space to mention a small portion of the works shown, but must notice a beautiful study for a tower, by Mr. John Calvin Stevens, of Portland, which well deserves its reproduction in the catalogue, and a drawing of an hotel at Orange Mountain, New Jersey, made by Mr. Hazlett for Mr. Arthur D. Pickering, which is singularly picturesque and brilliant, both as a drawing and design.

Mr. Cass Gilbert has also a pretty interior, sketched in pencil on tinted paper, with a little color over it, and a rather similar one, of a country house, heightened with white, and Mr. Stevens also some clever sketches, particularly one of a picturesque tower, which suggests Mr. Kirby. Both this, and a pair of slight drawings of a stone country house, by Mr. Wilson Eyre, of Philadelphia, are filled with the spirit of picturesque architectural grouping, which seems to flourish better in America than in any other modern country. As contrasted with these, we find an interesting series of school designs, made at the Paris School of Fine Arts by Mr. Richard M. Hunt, as well as geometrical drawings of the new portion of the Louvre, made by him as assistant to Lefuel. Just beyond, we find sketches of the successful design for the Madison Square Garden, by Messrs. McKim, Mead & White, showing the famous tower which is destined to become one of the architectural landmarks of New York, if it meets with the study which such an object claims from its designer. This reservation is perhaps the more judicious, as the interior sketch of the same building, which is shown near by, in an apology for a drawing by Mr. Hoppin, has the air of having been designed in about fifteen minutes, and drawn in about fifteen more, without even the preliminary ceremony of stretching the paper, which is drawn and "cockled" in all directions in consequence.

At this point we arrive at the entrance door of the Loan Exhibition of Decorative Art, signilized by a beautiful piece of wrought-iron, worthy of a Nuremburg blacksmith, which hangs over the door, and within we find numberless decorative paintings, stamped-leather hangings, and so on, which ought to have a separate description.

ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE CHURCH OF NOTRE DAME, MONTREAL, P. Q.

[Gelatine Print, issued only with the Imperial Edition]

This building which will seat 10,000 persons was built of limestone in 1824–9. It measures 255 feet in length and 144 feet in width.

THE TAVERN, DECATUR, ALA. MR. L. B. WHEELER, ARCHITECT, ATLANTA, GA.

This building, whose interior is to be decorated by Tiffany, will cost $125,000.

THE NELSON MEMORIAL HALL, KINGSTON, PA. MESSRS. KIPP & PODMORE, ARCHITECTS, WILKES-BARRE, PA.

This building is to cost about $22,000.

THE LOGAN OFFICES, PHILADELPHIA, PA. MESSRS. COPE & STEWARDSON, ARCHITECTS, PHILADELPHIA, PA.

HOUSES FOR J. H. CARTER, ESQ., AND FOR GEORGE L. FREEMAN, ESQ. MR. W. H. SYMONDS, ARCHITECT, UTICA, N. Y.

THE INTERIOR OF THE BARDO, TUNIS.

FOURTH ANNUAL REPORT OF THE BUREAU OF ETHNOLOGY.—I.

PICTOGRAPHS OF THE NORTH AMERICAN INDIANS.[1]

DETAIL OF TOMB
CATHEDRAL OF AMIENS.

One of the bright pages in the record of what may be called the higher functions of our national Government is to be found in its fostering of scientific inquiry. We still perpetuate the iniquity of according to foreign authors no rights under our laws, and thereby discouraging native literature to the utmost; we have made an exorbitant tariff for foreign works of art, and thereby done our best to retard the æsthetic development of our country; but in its promotion of scientific investigation our Government has long since merited the admiration of the intellectual world.

It seems particularly appropriate that a republic designed on the grandest scale yet known to be a government of man, by man and for man — to change slightly the phraseology, though not the purport, of a familiar saying — should make a special feature of the science of mankind, the youngest, and yet the greatest of the natural sciences, comprehending, in fact, all the others, and uniting them to its service. The work of the National Bureau of Ethnology, as a department of the Smithsonian Institution at Washington, is probably greater and more elaborate than any similar work conducted under the auspices or patronage of any other Government, and for its magnitude, as well as its quality, we are indebted to the scholarly mind and the energy of its director, Major J. W. Powell. The aboriginal races of America offer the richest field for ethnological investigation, and the results are certain to be of high practical, as well as scientific, value. Through the study of the so-called savage races, both in their living aspect and in the light which familiarity with present conditions throws on their archæological remains, we have the best key to a knowledge of human nature in the abstract, for it affords us the indispensable means of beginning at the very foundation which is necessary in all studies. We shall thereby be enabled to penetrate to the inner recesses of human action, motive and thought, and thus gain the means for the solution of many a mysterious problem. It is impossible to overestimate the importance of giving this knowledge into the keeping of the wisest men, and therefore necessarily the leaders, of the great nation which is to be composed of nearly all races of earth fused in a common crucible, and where the greatest problems of humanity are destined to be wrought out. For the primitive aspects of many questions of human nature and conditions which are vexing us, or are destined to vex us — such as the sociological problem — we have but to look to the wild races that still inhabit our territory, and to the records of centuries that they have left in the soil throughout the land from the Atlantic to the Pacific, and from the great lakes to the Gulf of Mexico, Here to well-trained eyes are opened chapters of knowledge which will bring about the correct understanding of many weighty questions.

The recently published "*Fourth Annual Report of the Bureau of Ethnology*" has a value in this respect which makes it worthy of its predecessors. Its elaborate illustration partially accounts for the delay in its appearance (it is for the year 1882–83), but its character makes us eager to see the four succeeding volumes now in hand. It also makes us feel the importance of instituting some system by which the scientific publications of the Government can be made more accessible to those who are most capable of appreciating them. In the first place, it should be a rule to send the reports to every public and incorporated library in the country, and to every higher educational institution, while the proposed plan of having the volumes placed on sale should be carried out. They are now largely distributed by Congressmen, like seeds from the Agricultural Department, as favors to constituents, and in great measure are pearls cast before swine. We are aware that the Bureau of Ethnology makes a special effort to get its publications into the right hands, but there is need of a regular system for the distribution of all scientific works of the Government.

The present report of the Bureau of Ethnology makes a large volume of 532 pages, comprising six papers by three contributors, with an editorial introduction by Major Powell, and is illustrated by 83 full-page plates, many of which are colored, and 564 figures in beautifully executed wood-engraving and process-work. The papers consist of an elaborate preliminary essay on "Pictographs of the

[1] By Garrick Mallery.

North American Indians," by Lieutenant-Colonel Garrick Mallery; Three Essays on Keramics, by Mr. William B. Holmes — "Pottery of the Ancient Pueblos," "Ancient Pottery of the Mississippi Valley," and "Origin and Development of Form and Ornament in Keramic Art;" and "A Study of Pueblo Pottery as Illustrative of Zuñi Culture-Growth," by Frank Hamilton Cushing.

These papers are a credit to American ethnological scholarship, and should furnish food for reflection to the dominant element in the American Institute of Archæology, which is disposed to see no field but that afforded by classical ground in the Old World, and which we feel inclined to hold responsible for the certainly not creditable fact that the latest number of that beautiful quarterly, the *American Journal of Archæology*, should contain but one page of notes concerning America amidst dozen of pages about the Eastern Continent. The publication thus belies its name, for there is next to nothing "American" about it, and such open disregard for its most appropriate field is adapted to give it an amateurish appearance in the eyes of European scientists. We are not disposed to underestimate the importance of classical archæology, which, however, constitutes but a very small proportion of the whole field. In fact, our very regard for the classical work makes us see the importance of the American, which affords peculiar opportunities for gaining the knowledge of the conditions out of which grew the exquisite blossom and fruit of classical culture, and which is therefore essential to a proper understanding of that culture. Neither do we urge a cultivation of the American field by Americans for so-called "patriotic" reasons, but because it is our legitimate territory, lying before our very door and beneath our feet. The disposition to regard classic archæology as alone worthy of pursuit by scholars, is a survival of the archaic habit of scientific exclusiveness long since replaced by the enlightened point of view that all branches of a science, and all sciences, are as interdependent for a correct understanding of each other and of any one, as are all the different parts of any organism to the existence of the whole and of each of those parts. Therefore the classic spirit can only be truly understood in its highest value and significance in the light of the ethnology and archæology of primitive peoples.

Major Powell's thoughtful comments on these papers aid very materially to an assimilation of their meaning and conclusions, as well as an understanding of the preceding work of their authors which led up to these. Colonel Mallery's paper is the longest, occupying the greater part of the volume with 345 pages, including illustrations. It is worthy of mention here that this paper so interested Mr. Francis Galton that he conceived and carried into execution the idea of making a series of pictographic medallions, each devoted to a leading or significant event, symbolically illustrated, in one's life, and this he suggested as a new and fascinating field for the exercise of amateur artistic talent. Such a set of medallions might be modelled or engraved, and reproduced in metal, making a beautiful chain or necklace to be preserved as an heir-loom, or given as a family present. The idea seems an admirable one, and amateurs should be grateful for it.

Indian Pictographs.

Colonel Mallery has for some years made a specialty of the study of sign-language among the Indians, and his present researches in pictography are, it may be easily perceived, intimately associated with the former, since the graphic representation of ideas is naturally akin to their representation in gesture-speech, the same fundamental principles underlying both. As Major Powell remarks, "both of these modes of conveying ideas and facts, by one of which they are also recorded, prevail among the North American Indians with a development beyond that found among any other existing peoples, and therefore the study of both developments among them is most advantageous when combined." Colonel Mallery has accumulated an enormous quantity of material on the subject, and this paper, voluminous as it is, is but preliminary to the undertaking of an exhaustive monograph. The present paper is therefore confined to a presentation of experiences and results, serving the almost vitally important purpose of communicating to others already interested in the subject the amount and character of the information so far obtained. Their coöperation is thus enlisted, and their own investigations are promoted by the suggestions received from the important work of another. The working up of theories is postponed until the collection and comparative study of the materials gathered, has been far advanced towards completion.

Here, therefore, pictographic characteristics are explained and classified, and suggestions are made for the collection, description and study of specimens. The following editorial summary by Major Powell gives a concise statement of the character of the paper: "The author has first stated the distribution in North America of pictures on rocks, either painted or incised, or both, with a few illustrative comparisons from foreign countries. He has then enumerated the instruments used at different times in pictography, together with the coloring matters employed and the methods of application. The materials upon which pictographs are made are discussed, the objects being divided into natural and artificial. The first division includes many objects, consisting chiefly of stone, bone, living trees, wood, bark, skin, feathers, gourds, horse-hair, shells, earth and sand, and the human person. Designs upon the human person are in paint and by tattooing. Under this head much information is presented for the first time, and it is compared with some recently published accounts of the process in the Pacific Islands. The subject is then considered with reference to the special purposes for which pictography has, in fact, been employed by the North American Indians. They are: 1, Mnemonic, embracing order of songs, treaties, war and time; 2, Notification, comprising notice of departure and direction, of condition, warning and geographic features, claim or demand, messages and communications, and record of expeditions; 3, Totemic: this embraces tribal, gentile and personal designations, insignia and tokens of authority, personal names, property-marks and status of individuals, and signs of particular achievements; 4, religious, comprising mythic personages, shamanism, dances and ceremonies, mortuary practices, grave-posts, charms and fetiches; 5, Customs and habits, requiring details rather than classification; 6, Tribal history; 7, Biographic, in which are examples giving continuous record of events in a life, and other cases of particular exploits and occurrences. The manner in which pictographs have long been employed by the North American Indians, showing their advance from simple objective representations to true ideographs, is then discussed, and instances are given of their expression of abstract ideas of emblems and of symbols. Indications for classification are noted by identifying the pictographers through their general style of type, and through the presence of characteristic objects. Modes of interpretation are recommended, with cautions originating in experience. Attention is invited to the important bearing of conventionalization, hints are given for avoiding errors, and, finally, practical suggestions are submitted intended to assist investigation and simplify its record. Under every heading several examples appear, with requisite graphic illustrations."

Colonel Mallery's opportunities for beginning the study of pictographs were exceptionally fortunate. His first studies were upon the remarkable pictorial chart, with which he became acquainted in the winter of 1876, represented to be a history of the Dakota Indians, but which he ascertained was not strictly historic, its purpose being to designate successive years by the most remarkable, or rather the most distinguishable, events that occurred in each. It therefore became useful chiefly as a calendar. His next study was sign-language, affording instructive parallels with the Dakota calendar and with other forms of pictography. His point of view on approaching the subject was therefore the most simple and direct. In the words of Major Powell: "There was in him no bias towards a mystic interpretation, or any predetermination to discover an occult significance in pictographs, whether on rocks, skins or bark. The probability appeared, from his actual experience, that the interpretation was a simple and direct, not a mysterious and involved process, and the course of his studies natura'ly tended to ascertain, collocate and compare facts, but to eschew suppositions. At the same time the author by no means denies or forgets that poetry and imagination may be discerned in the Indian pictographas as well as in their

gesture-speech and in their spoken languages. He acknowledges, and illustrates by examples given, that pictographs are, in many cases, figurative, metaphoric and symbolic. It is also recognized that, in a very few instances devices may be so far esoteric as to have been adopted as emblems, with some concealed significance, by the secret religious associations long known to have existed among the tribes. This admission is not, however, to allow of resort to mystic symbolism as a normal mode of interpretation. In the examination of pictographs of the North American Indians, so far as it has progressed, the order in which to direct interpretation is the same as that of theoretic evolution and of ascertained historic sequence. . . . The author has, therefore, presented the facts so far known to him, simply as facts. When a pictograph has appeared from intrinsic or extrinsic evidence to convey an idea beyond its objectivity, the fact has been noted. Decisive extrinsic evidence in each case is required for the adoption of mystic symbolism as the true mode of interpretation. By this method of treatment the subject of pictographs has been rescued from the limbo of morbid fancy to be marshalled with proper place in the evolutionary order of human culture."

Major Powell is right in his characterization of the straining after mystical interpretations which has so long characterized, perhaps, the greater part of the attempts to study pictographs, and the methods laid down in this paper are the rational ones, which should be pursued by all serious investigators. At the same time, however, it appears likely, in view of the important part which esoteric organizations play in the life of the Indians, that pictographic devices have an esoteric significance to a greater extent than perhaps Major Powell is inclined to admit. A valuable line of research would be to pursue the lines upon which devices have grown in significance from a simple, direct and evident meaning to a complex, involved and esoterically emblematic meaning. To this end a comparison with the growth of symbolical meanings in the esoteric organizations of our own civilization will be of exceeding importance.

The study of pictographs is one of the most important factors in throwing light upon the ways and methods of thought characteristic of primitive man, and it is hardly necessary to add that for their correct study it will be found to be an absolute necessity for the student to enter into and for the time being completely identify his own mind with the habits of thought peculiar to primitive man. The failure to do this and the insistence upon carrying over to the examination of savage institutions our own civilized modes of reasoning and viewing their growth in the light thereof, is one of the most fruitful sources of the multitudinous fallacious conclusions that have characterized ethnological research — conclusions hardly more erroneous than those reached from the hasty generalizations of the traveller who deems himself competent to "size up" an alien people on the basis of the most superficial observations.

Indian Totem-Posts.

Fifty-seven pages of Colonel Mallery's paper are devoted to a description of the calendar-charts or "winter-counts" of the Dakota Indians, and among the illustrations is a beautiful colored lithograph of the famous Lone Dog calendar, painted on a buffalo robe by the Indian of that name, and representing the seventy-one winters beginning with 1800–01. This is the chart which, as aforesaid, attracted the attention of Colonel Mallery to the subject. This was the first attempt ever heard of among the Indians west of the Mississippi to establish a chronological system. This chart and its purpose was found to be well known throughout the Dakota nation, and various copies as well as similar charts were afterwards discovered.

It is believed that the chart originated in the habit maintained by Lone Dog ever since his youth, with the counsel of the old men and authorities of his tribe, of deciding upon some event or circumstance which should distinguish each year as it passed, and when such decision was made marking what was considered to be its appropriate symbol or device upon a buffalo robe kept for the purpose. The robe was at convenient times exhibited to other Indians of the nation, who were thus taught the meaning and use of the signs designating the several years in order that with the death of the recorder the knowledge might not be lost. Colonel Mallery holds that the peculiar mode of record was an invention, and not probably a very old invention, as it has not, so far as known, spread beyond a definite district or been extensively adopted. Had it been of great antiquity, it would probably have spread by intertribal channels beyond the Dakotas, where alone such charts have been found and are understood. It has been suggested that the idea might have come from contact with the whites, either missionaries or traders, but this seems improbable. "Instead of any plan that civilized advisers would naturally have introduced, the one actually adopted — to individualize each year by a specific recorded symbol or totem, according to the decision of a competent person, or by common consent acted upon by a person charged with or undertaking the duty whereby confusion was prevented — should not suffer denial of its originality merely because it was ingenious and showed more scientific method than has often been attributed to the northern tribes of America." In the Lone Dog chart, "the careful arrangement of distinctly separate characters in an outward spiral starting from a central point is a clever expedient to dispense with the use of numbers for noting the years, yet allowing every date to be determined by counting backward or forward from any other that might be known."

The name "Winter-counts" comes from the fact that the Dakotas naturally count their years by winters, the season in their high levels and latitudes practically lasting more than six months, and they say that a man is so many snows old, or that so many snow-seasons have passed since an occurrence. A few instances of the method of designation may be given. The characteristic event of the winter of 1800–01 was, according to Lone Dog, the fact that thirty Dakotas were killed by Crow Indians. The device signifying this consists of thirty parallel black lines arranged in three columns of ten lines each, the outer lines being united. In the chart made by Lone Dog, such black lines always signify the death of Dakotas killed by enemies. The next winter has for a device the head and body of a man covered with red blotches, and it signifies that there was an epidemic of the small-pox in the nation. One record calls it the "Small-pox-used-them-up-again winter." The succeeding winter is designated by a figure of a horse-shoe, which means that at that time the first shod horses were seen by the Indians, and the season is therefore known as the "Brought-in-horse-shoes winter." As a last instance may be taken the winter of 1876–77 in the chart made by the Flame. That was the winter of Custer's defeat, and in his comments on Lone Dog's chart, published in 1877, Colonel Mallery remarked: "The year 1876 has furnished good store of events for his choice, and it will be interesting to learn whether he has selected as the distinguishing event the victory over Custer, or, as of still greater interest, the general seizure of ponies, whereat the tribes, imitating Rachel, weep and will not be comforted because they are not." It turned out that two of the counts selected the event of the seizure of the ponies, and none of them yet seen make any allusion to the defeat of Custer. This is a striking fact. The disposition of our own race would of course be to chronicle a victory of such great importance, but a misfortune appears to have been a more memorable event with the Dakotas. It would be interesting to see if this tendency were a general trait of Indian character. Colonel Mallery's paper includes a valuable and elaborate communication from Dr. William H. Curbusier, assistant surgeon, U. S. A., on the subject of Dakota winter-counts, containing much of special value and importance.

Under the head of pictographs upon the human person, there is an interesting contribution by James G. Swan on "Tattoo Marks of the Haida Indians of Queen Charlotte Islands, B. C., and the Prince of Wales Archipelago, Alaska. Some errors of Hubert H. Bancroft's history in this respect are corrected; errors inevitable in a work, valuable though it is, largely the result of compilation. Tattooing is almost universal among the Haidas, but few white people who have come into contact with them are aware of the extent to which it prevails. "It should be borne in mind," says Mr. Swan, "that during their festivals and masquerade performances the men are entirely naked and the women have only a short skirt reaching from the waist to the knee; the rest of their persons is exposed and it is at such times that the tattoo-marks show with the best effect and the

rank and family connections known by the variety of designs. Like all the other coast tribes, the Haidas are careful not to permit the intrusion of white persons or strangers to their Tomanawos ceremonies, and as a consequence but few white people, and certainly none of those who have ever writen about those Indians, have been present at their opening ceremonies when the tattoo-marks are shown." To illustrate this tattooing and its relations to other features of Haida design, a view taken at Massett, Queen Charlotte's Island, of the carved columns (totem posts) in front of the chief's residence is given and also representations of the tattoo-marks on two women and their husbands. "It is an interesting question," says Mr. Swan, "and one worthy of careful and patient investigation, Why is it that the Haida nation alone of all the coast tribes tattoo their persons to such an extent, and how they acquire the art of carving columns which bear such striking similarity to carving in wood and stone by the ancient inhabitants of Central America, as shown by drawings in Bancroft's fourth volume of '*Native Races*' and in Habel's '*Investigation in Central and South America?*' . . . The tattoo-marks, the carvings and heraldic designs of the Haida are an exceedingly interesting study, . . . they seem to me to point to a key which may unlock the mystery which for so many ages has kept us from the knowledge of the origin of the Pacific tribes."

SYLVESTER BAXTER.

PECULIAR ORIGIN OF FIRES.

WHEN it is considered that there is not a process or method of manufacture which does not contain more or less the possibility of a cause of fire, and that these various processes differ one from another in the relative hazard, then it will be conceded that there is scarcely an element in the whole range of manufacture which is not in a like manner a factor in the question of safety and of insurance. The larger amount of losses is, as would naturally be assumed, due to oil, both in consequence of its imperfect use on journals and the hot bearings which result from a lack of proper lubrication. In the mechanical processes of dyeing and bleaching there is a great deal of chemical action, which at times results in ignition. With such rapid machinery as that of the picker-room in cotton and the dusting-room in paper-mills, there is great liability of sparks; such sparks are the antecedents of fires which occur among the light, textile, fibrous material found in such machines, and enormous fires occur from other causes which certainly entitle them to be classified as among instances of proverbial happening of the unexpected.

One large insurance company in America declares that their aggregated payments for fires caused by lanterns have reached nearly $2,000,000. The causes of these fires from oil are threefold, and they are all included in what an underwriter would call the preventable cases of fires. The use of lard or sperm oil of the very dubious purity generally offered in the market is always attended with a crusting wick, and many a watchman or repairing-laborer in the night has unwittingly started fires caused by opening the lantern and picking the wick to remove the crust in order to get a better flame. For such lights, more satisfactory results are obtained by the use of what is known as the signal oil, which consists of a mixture of animal oil and mineral oil. In many places the instructions of the manager that the lantern should never be opened except in the boiler-room or some similar place of safety are carried into execution by placing spring-locks on the lantern, which cannot be opened except by a key hung up in the boiler-room.

Other fires are caused by a lamp dropping out of a lantern; any type of lantern where the lamp is placed in at the bottom is liable to such an accident, notwithstanding the method of construction may be such as to guard against that difficulty when new. In some lanterns closed at the bottom, the globe at the top is removed in such a way that the hand reaches down to the light. In others, the lamp of the lantern, although at the bottom, is secured in its place by a hinge, so that at worst, in case of any mishap, it would only swing down and not fall.

The tubular lanterns, made solely for burning kerosene, have been the source of a great many fires by reason of poor methods of construction. They are soldered by an easily-fusible alloy, and when such lanterns are hung up in places of unusual warmth and the light turned up somewhat higher than usual, the upper part of the lantern sometimes is heated sufficiently to melt the solder so that it falls apart. This is an accident entirely inexcusable when it is considered how readily lanterns are constructed without depending upon the soldered joint for the attachment of the handle to the body of the lantern, but use rivets, locked joints in sheet metal, and eyes bent in wire guards.

A curious lantern-fire resulted in the burning of an American mill, and at the same time subjected an innocent person to an unjust suspicion. The facts were that the mill very suddenly burned at an early hour of the morning, the only direct evidence upon the case being that of the watchman, who testified that while making his round he entered the upper portion of the mill, finding the room in flames, but beyond control. There were many details of circumstantial evidence connected with the fire which convinced the underwriters that the fire was incendiary in its origin, and this, coupled with the fact that the mill had not been financially prosperous for some time, and also that the proprietor did not possess a reputation above suspicion in commercial affairs as to strict integrity, diverted a great amount of suspicion towards him. This suspicion was not sustained by any direct evidence inculpating him with incendiarism, yet the underwriters refused to insure a second mill which was rebuilt on the ruins of the first. Fifteen years later the proprietor of the mill was awakened in the middle of the night by a message from a priest who was receiving the confession of the watchman now on his deathbed, and related to the priest that he had accidently set the mill on fire by breaking his lantern against a machine; fearing that he would be put in prison for the act, he had disclaimed all knowledge respecting the origin of the fire. At a later day, learning how suspicion had adverted to his employer, he dared not state the truth, although the crime had haunted his conscience for all those years. The priest refused to administer the rites of the church until the watchman's confession had been repeated to the proprietor.

Water is generally referred to as the ideal antagonist of fire, and yet there are many instances where water has caused fires, as in the case of a mill in Rhode Island, U. S., where the supply of water to an overshot wheel was regulated by an immense gate, called a leather apron, used in former days for that type of water-wheel. During the night a sudden storm raised the water in the river, and imposed an unusual pressure against the leather apron, which had become old and unsound, broke it, let a flood upon the water-wheel revolving it with unusual velocity, and ignited the mill in several places on account of the friction of the hot bearings. Another instance was that of a Connecticut mill, where the flood raised the river to a sufficient height to cover the first floor of a machine-shop to the depth of about two feet. The water rose very rapidly, and there being a large amount of iron-turnings commingled with wood-chips on the floor of the machine-shop, the iron-turnings oxidized so rapidly that the heat of the process ignited the wood and started a fire which cost the underwriters $30,000.

Fires produced by the action of water upon lime are so frequent as not to require especial notice in this reference to fires outside of the expected and well-known causes.

Streams from hose used in extinguishing fires would not ordinarily be classed among the causes of fire, yet such results have occurred is at least two instances. In the one, a stream upon a small fire also met some lime in a neighboring building, starting a fire which did not attract attention until it reached an extent threatening serious results. The other instance was in a large store in Philadelphia, where the stream of water, charged with carbonic acid gas discharged from an extincteur upon a small fire, also served as an electric-conductor, and started another fire from the arc-lighting system.

The oxidation of iron-turnings is quite frequently the cause of mysterious fires, igniting sheds used for storing scrap around iron-working establishments. There have been numerous fires in the roofs of foundries caused by explosions of melted iron thrown violently against the roof when by any mishap the iron came in contact with water.

The foundations for a light building upon a very yielding soil were arranged by placing posts down in tubs of iron-turnings set in the earth in proper situations, and then pouring over the iron a solution of salt in water. The iron-turnings rusted into a solid mass, but the process was carried on so quickly that the heat of oxidation charred the lower ends of the posts, holding them firmly, and also served as as an antiseptic treatment, diminishing the liability to decay.

The combustibility of iron is quite noticeable in tack factories, where the tacks are polished by attrition against each other on revolving cylinders, and the fine comminuted dust is so easily combustible that it has served as the source of several fires that were started from some slight accident like dropping a match or exposure to an open light.

Certain forms of fireworks, known as parlor fireworks, obtain some of their most beautiful effects from the combustion of fine iron. The sun, on the other hand, also serves its purpose as a factor of insurance. For its rays have been time and again concentrated upon combustible matter by bull's-eyes, in such a form that they crudely acted as a double convenx lens when placed over doors. It is also a frequent incident in physical laboratories, that large double convex lenses are left in such position that the sun will reach them in time and start fires. In fact as a protection against such accidents, these lenses should always be covered with a cloth bag when not in use. Dishes of tinned-iron for domestic use have also concentrated the rays of the sun, as any concave mirror might, upon combustible matter; and it is a well-known fact that two considerable fires in America, one at Lynn and the other at Sheboygan, were both caused in this manner by the tin-dishes in the window of an ironmonger's shop. There are other fires caused by peculiar circumstances comparable to that of the "arrow shot at random reaching the joint of the armor;" as, for instance a hotel-keeper at Biddeford was so rejoiced at the election of President Cleveland, that he set off a number of fireworks in front of his hostelry in honor of the event. A

rocket shot up into the air and descended in a vertical direction into the dust chimney of a cotton-mill in the vicinity. Reaching the bottom of the shaft, it exploded, igniting the dust-room and starting a serious fire. Sparks are sometimes the cause of fires as a result of the most unexpected circumstances. In an establishment making table-knives, a milling-machine which finished the outside of the knife-handles was cleared of dust by a large tube projecting down from the room above and connected to an exhaustive blower in the attic. An emery-wheel which had been in the same position for a number of years, situated about twenty feet from this milling-machine, struck a spark against a window; thence glancing back, it rebounded some twenty feet igniting the dust in the lower part of this tube. The flame was carried by the blower to the room above and through a hole in the roof, causing a destructive fire which was not known to the occupants of the room until an alarm had been given by those who had seen it from the outside of the building.

In another instance, a spark from an emery-wheel struck the window in front of the wheel; this glancing back to the belt rebounded again, and entered a crack between the upper part of the window-frame and the masonry of the building and ignited the impalpable dust situated there, an accident which had never occurred before, although that machine had been in the same position subject to daily use for over twenty years. Although sparks from grinding-wheels frequently ignite combustible matter, yet it is a very difficult thing to do the same thing designedly even by holding fine matter, as cotton card-waste, in a line of the sparks as they are thrown off from the wheel. There have been numerous fires in cotton-mills caused by sparks from the dull-axes used in chopping hoops of cotton-bales, and yet it would be considered an impossibility if one were to take the task of setting the cotton on fire in this manner. A carpenter, while nailing a board to the ceiling in a picker-room of a jute-mill, struck a nail on one side so that it glanced across the room, entering the feeding-apron of a jute-picker and struck a spark which ignited the stock, passing through the picker, and thence spreading to a very severe fire.

The capability of steam-pipes to set fire to wood will doubtless continue to be a moot question in the face of conclusive evidence to the contrary, merely because such fires cannot be produced at will.

A few years ago a steam-pipe covering composed of wood-pulp and ground wool-waste was extensively introduced into American markets with the result of being ignited quite frequently by hot steam-pipes. There have been a few instances of the ignition of hair-felt used for such non-conductors; in the course of investigation upon some fires of that class, it was found that while the hair-felt was not combustible at ordinary temperatures, yet when it had been warmed to higher temperatures it was quite readily combustible. Fires are of frequent occurrence in drying-rooms heated by steam-pipes for seasoning small bits of lumber used in the decorative portions of cabinet-work, under circumstances which do not permit any hypothesis of spontaneous combustion, because the wood at that time has not received any treatment from oils or varnishes.

A mill in Providence, R. I., was burned by a fire originating from the steam-pipes in an unlooked-for manner. At the time of its construction, the proprietor exercised great care that all pipes should be free from direct contact with the woodwork, but when the steam was let into the pipes the expansion increased their length and pushed their end against the wood partition, which was eventually set on fire. Although the fact of fires originating from steam-pipes is well established, there is still some obscurity as to the exact subjects which produce such combustion. It is well known that the ignition point of charcoal bears a certain ratio to the temperature of carbonization; the lower the temperature the more readily combustible the charcoal, and this fact is made use of in producing charcoal for the manufacture of some grades of gunpowder by means of superheated steam. Yet applying the data which have been published upon the subject, it will be readily seen that the ignition point of charcoal produced at even the temperature of boiling water, is in excess of the heat of steam at the highest working-pressure, and yet there are instances of fires produced by steam-heating pipes at pressures as low as ten pounds and also from the heat from the kiers containing hot water used in bleaching. It seems probable, however, that the charcoal which is ignited under these conditions is not that charcoal which has been carbonized by direct contact with steam-pipes, but rather that which has been carbonized by radiation from steam-pipes, and therefore, at a materially lower temperature than that of the pipe, and then by some changes this charcoal is brought into absolute contact with the steam-pipes. Fires from spontaneous ignition of oily waste are so alarmingly prevalent that, as such, an allusion to them has no place in a list of peculiar fires. The introduction of mineral oils for lubrication has tended to reduce this class of fires materially, as the paraffin oils will not oxidize at ordinary temperature, and when commingled with animal or vegetable oils in proportions varying from one-third to one-half, it will also prevent such oxidations of the other oils contained in the mixture.

A watchman in the locomotive works in Boston was very much alarmed when, one evening, the safety-valve of the boiler, which was used only for heating in winter, began to blow off, and he learned that there was a dangerous pressure of steam in the boiler and a fierce fire upon the grates. After the fire was dulled by a stream of water, the matter was investigated, and it was found that the furnace under the boiler had been a receptacle for a lot of small bits of wood in the cleaning up of the boiler-room which followed a spasm of order on the part of the boiler-tenders; then later, some other person threw some oily waste matter into the furnace-door as the best method of getting rid of a dangerous article. A beetle flying into a mill at night became caught in a bit of sliver and straightway flying into the gas-jet, dropped and started a fire among the contents of the card-room. In another instance, a can of cotton-sliver in a cotton-mill was found to be on fire, and investigation afterwards revealed the fact that the can was in contact with the belt over the pulley, and the friction of the belt on the outside of the can produced enough heat to ignite the cotton. There are records of several similar instances. The blow-off pipe of a boiler burst, causing a back draught, and the flames coming out of the doors of the boiler-furnace set the roof on fire.

On the Pennsylvania Railroad, an exhaust blast-tube of a locomotive turned around, so that it blew a blast in the reverse direction into the furnace of the boiler, and the flames bursting out of the furnace door set the cab on fire, driving the engineer and fireman from their post to a refuge in the water-tank of the tender. The engineer, under circumstances of great bravery, came out and reversed the engine, saving the train from a total wreck, although he paid his life as a forfeit for his bravery.

One of the most peculiar fires resulting from a sequence of unhappy circumstances was that of a storehouse connected with a mill in Vermont, U. S. Oil is transported on American railways in tank-cars, in which a cylindrical tank about five feet in diameter and twenty-five feet in length is secured upon a platform-car. One of these cars was standing upon the siding of a railway near the storehouse, when one of the rear cars of a freight-train passing by on the main track jumped the switch at the siding. Numerous persons had observed that this rear car had a hot bearing, which had already ignited the oil on the journal, and, as it tore away from the train and plunged down into the oil-car, breaking the iron tank, the flames from the hot bearing ignited the oil running out from the broken tank on to the ground, and surrounding the storehouse, burned it down.

These fires are all from an American source of information, and while the conditions may not be the same to repeat the identical results in all instances among any industries, yet it is none the less true that destruction of property is quite frequent from unexpected causes, which are nevertheless preventable in their nature.—*Engineering.*

THE GREAT NOVA SCOTIA RAFT AND ITS PROGENITORS.

CAPITAL FROM DEERHURST CHURCH.

WHEN we last week again drew attention to the monster raft which left Nova Scotia on the 5th inst. for New York, we excused the brevity of our comments on the speculation till we knew whether or no the huge quantity of timber chained together would reach its destination or come to grief, as we had our apprehensions of the adventure being a risky one, and, as many expected, it has so far come to grief that it is adrift on the open ocean, entirely at the control of the elements. An easterly gale sprang up on Sunday, the 18th, and in latitude 40° 16′, longitude 70, the tow-line parted, and the raft was lost, and when last seen was drifting in a southerly direction.

In the accounts of the disaster yet to hand no mention is made of the steersman—or was there none? If so, the voyage must have been hopeless from the first, as in a contrary wind or a cross-current it would be impossible to keep an elongated mass of material as this presented from coming athwart without something in the shape of a helm. The towing appears to have been set down as too easy a job, and it is evident proper provision was not made to meet one of the land-gales, or rather, hurricanes, which are so frequently encountered along the Atlantic coast.

If it was worth while to build a raft on such a gigantic scale, it was certainly false economy to put it under the management of one steamer. This vessel, called the "*Miranda*," may have been of sufficient power to have towed the raft, but when the connection was severed by the parting of the tow-line, all control was gone till the gale subsided, and the chance of clawing hold of this floating island of wood, with seas running mountains high, became no light undertaking. The catastrophe might have assumed a less serious form had two tugs been employed, as when one line parted there would have been the other holding on, affording time for the other to again lend her help.

We shall not be a bit surprised, however, to hear that the "*Miranda*" has again picked up the raft, which, of course, in fulfilment of her contract, she will go in search of directly the gale moderates. One would have thought that a prudent commander, as soon as his line parted, would have run down to leeward of the sea-washed mass, and there ridden out the storm in comparative comfort, the huge pile of timber forming a splendid breakwater.

In severe gales, where there is danger of a ship straining, it is not unusual for those in charge to get all the spare spars lashed together and launch them overboard, secure with a strong line, and allow the

ship to drift to leeward, slacking up till the spars or raft is sufficiently far to windward to break the force of the sea.

We cannot understand why, in the storm, the "*Miranda*" continued to tow; she should have slacked up and saved the strain on her cables, keeping as near the raft as she safely could, but, of course, there may have been circumstances of which we know nothing that made it expedient for the steamer to look to her own safety, and, perhaps, after all it was a case of abandoning the raft instead of the tow-ropes parting. This view has some coloring in it from the fact that a United States man-of-war is said to have been sent in search of the "raft," but if the "*Miranda*" had not broken down, we cannot see why she was not quite as capable of looking after the raft as any other vessel.

In 1792 a raft containing about 1,000 tons of timber was built at Swan Island, in the Kennebec, by Dr. Tupper, a somewhat noted eccentric character. It was made by tree-nailing square timber together in the form of a ship's hull, and was ship-rigged, the intention being to send her across to England. At that time no manufactured lumber was admitted to the ports of Great Britain; hence the timber in the raft was simply squared with the axe, to make it stow well. The ship or raft lay at Bath for some time, it being difficult to get men to go in her. She finally went to sea, however, carrying a small vessel on her deck. But off the Labrador coast her crew became frightened by bad weather and abandoned her. She was afterwards boarded by men from a passing vessel and found to be in good order, and it was suspected that she was deserted without sufficient cause. Two other similar attempts were made from the Kennebec, and both vessels went safely across, but foundered on the English coast, under the same suspicions of fraud as in the case of the Tupper ship. In 1825 the ship "*Baron of Renfrew*" was launched at Quebec, having made a previous unsuccessful attempt, when stopped on her way, owing to the grease being consumed by fire from friction. She was towed down to the Island of Orleans and anchored. Her dimensions are given as follows: Length, 309 feet; breadth, 60 feet; depth, 38 internally and 57 externally; tonnage, 5,888 tons; draft when launched, 24 feet; cargo on board when launched, 4,000 tons of timber. She was ship-rigged, with four masts, and was perfectly flat-bottom, with a keel of about 12 inches, wall-sided, sharp forward and rather lean aft, and looked more like a block of buildings than a ship. She sailed in August, 1825, drawing 36 feet of water, in command of a Scotchman, a half-pay lieutenant in the British navy. October 27, the "*Baron of Renfrew*" drove on shore on the coast of France, near Calais, and went to pieces.

It is evident there are too many contingencies attached to rafting timber across the ocean to make it probable that any such method of transport will ever become general even if this Nova Scotia raft ultimately reaches its destination.

For the information of those of our readers who may not have retained the particulars we gave of this extraordinary structure, we may mention that the raft consists of twenty-seven thousand trees, bound together by a series of chains which connect those around the outer edges with a larger central chain, running lengthwise along the mass. The shape of the raft resembled that of a cigar, its length being five hundred and sixty feet, greatest diameter sixty-five feet, the weight of the raft being eleven thousand tons. The total cost of the raft, including timber, construction and transportation, is about thirty thousand dollars. The raft has the capacity of seventy large schooners, and the usual freight charges alone for this amount of timber are twenty-five thousand dollars. Two other rafts of the same size are now being built in Nova Scotia.

This mighty mass of timber, though estimated by some of our American contemporaries to be equal in weight and dimensions to the still "living," but not for long, wonder of the world, the "*Great Eastern*, falls far short of the bulk and capacity of that Leviathan steamship, and we are well within the mark when we state that the big steam vessel could stow all the trees in the Nova Scotia raft and a score of big shiploads besides, her burden being 22,000 tons, and her length 700 feet, and breadth over all 87 feet. The raft, it will be observed, falls far short of this, and is a long way removed from exceeding the largest ship afloat, one of Her Majest's ironclad fleet, the "*Northumberland*," being over 12,000 tons, if we take the actual burden, which in comparing with a raft of solid timber it is only fair to do. Those who have been out at sea in bad weather will fully understand the magnitude of the task the shippers of this huge mass of timber undertook, and those who have invested in the venture will wait with bated breath the news which passing vessels which have sighted the floating mass will bring. To vessels ignorant of its composition the first sight will lead them to the conclusion that they must have got out of their reckoning, whilst some amongst the superstitious might think that they had met with the great sea-serpent at last. It will not surprise us to hear some more legends of that great unknown animal conveyed to us by those whose glasses have been pointed in the direction of the "raft," when the weather was misty or a gale blowing that gave them no opportunity of taking more than a flying look. — *Timber Trades Journal.*

A SUPPORT OF THE CHURCH. — A gentleman generous in his contributions for church purposes, but not regular in his attendance upon public worship was wittily described by a clergyman as being "not exactly a pillar of the church, but a kind of a flying-buttress, supporting it from the outside." — *Exchange.*

SIX YEARS' LABOR TROUBLES.

THE Boston *Herald* presents the following abstract of Commissioner Carroll D. Wright's third annual report of the Bureau of Labor, which relates entirely to strikes and lockouts for the period of six years, ending December 31, 1886. It gives the result of the first general investigation ever made by any nation of the facts concerning strikes and lockouts for any extended period or for any wide extent of territory. The report covers about seven hundred printed pages and gives the details of each strike and lockout occurring in the United States during the period named. It exhibits the facts belonging to each industrial disturbance for each locality where trouble was found, without attempting to establish or decide upon the connection between them. The following table shows the number of strikes occurring during each of the last six years, the number of establishments involved and the average number of establishments involved in each strike:

Years.	Strikes.	Establishments involved.	Average No. of establishments involved in each strike.
1881	471	2,928	6.2
1882	454	2,105	4.6
1883	478	2,759	5.8
1884	443	2,367	5.3
1885	645	2,284	3.5
1886	1,412	9,893	7.0
Totals	3,903	22,336	5.7

In 1887 there were, according to the best information obtainable, 853 strikes, details of which are not available. The report shows that, during the six years covered by the investigation, New York had the largest number of establishments affected both by strikes and lockouts, there being for the former 9247 and for the latter 1528.

The building-trades furnished 6060 of the total number of establishments engaged in strikes. The total number of employés involved in the whole number of strikes for the entire period is shown to have been 1,318,624. The number of employés originating the strikes was 1,020,832. The number of employés in all establishments before the strikes occurred was 1,662,045, while the whole number employed in the establishments involved after the strikes occurred was 1,636,247, a loss of 25,798. There were 103,038 new employés engaged after the strikes, and 37,483 were brought from other places than those in which the strikes occurred.

In 2182 establishments lockouts were ordered during the period named. In these there were 173,995 employés before the lockouts occurred and 169,436 after, while the number actually locked out was 159,548. There were 13,976 new employés secured at the close of the lockouts and 5682 were brought from other places than those in which the lockouts occurred.

"It should be remembered, however," says the report, "that these figures do not represent the actual number of individual establishments or different employés engaged, as in many cases there have been two or more strikes or lockouts affecting the same establishment in the same year. In such cases the establishments and the number of employés engaged are duplicated."

Of the whole number of employés involved in strikes during the six years 88.56 per cent were males and 11.44 per cent females. Of those in lockouts during the same period, 68.78 per cent were males and 31.22 per cent females.

An examination of the tables appended to the report shows that New York, Pennsylvania, Massachusetts, Ohio and Illinois represent 74.74 per cent of the whole number of establishments affected by strikes throughout the country and 90.80 per cent of the lockouts. These five States, it is stated, contain 49 per cent of all the manufacturing establishments and employ 58 per cent of the capital invested in mechanical industries in the United States. Of the 22,336 establishments in which strikes occurred, in 18,342 or 82.12 per cent of the whole strikes were ordered by labor organizations, while of the 2,182 establishments in which lockouts occurred 1,753 or 80.34 per cent were ordered by combinations of managers. Of the whole number of establishments temporarily closed for business, 13,443 or 60.19 per cent were on account of strikes; on account of lockouts, 62.60 per cent. The average duration of stoppage on account of strikes was 23.1 days and for lockouts 28 days.

The results of the strikes, so far as gaining the objects sought are concerned, are shown to be as follows: Success followed in 10,407 cases, or 46.59 per cent of the whole; partial success in 3,004, or 13.45 per cent of the whole, and failure followed in 8,910 cases, or 39.89 per cent of the whole. By lockouts 564 establishments, or 25.85 per cent of the whole, succeeded in gaining their point; 190, or 8.71 per cent partly succeeded, and 1,305, or 59.80 per cent, failed.

As to the causes or objects of strikes, it is shown that increase of wages was the principal one, 42.44 per cent. The other leading causes are given as follows: For reduction of hours, 19.45 per cent; against reduction of wages, 7.75 per cent; for increase of wages and reduction of hours, 7.67 per cent; against increase of hours, 62 per cent. Total for the five leading causes, 77.83 per cent. All other causes, 22.17 per cent.

Disclaiming absolute accuracy, the report gives the losses of employés and employers resulting from strikes and lockouts as follows: Losses to strikers during the six years, $51,816,165; loss to employés through lookouts for the same period, $8,132,717, or a total wage-loss to employés of $59,948,882. This loss occurred for both strikes and lockouts in 24,518 establishments, or an average loss of $3,445 to each establishment, or of nearly $40 to each striker involved. The assistance given to strikers for the same period, as far as ascertainable, amounted to $3,325,057; to those suffering from lockouts, $1,105,538, or a total of $4,430,595. These amounts, however, the commissioner says, are undoubtedly too low.

The employers' losses through strikes for the six years amounted to $30,732,653; through lockouts, $3,432,261, or a total loss to the establishments involved of $34,164,914.

The tables also show that the chief burden of strikes was borne by 13 industries, viz.: Boots and shoes, 352 establishments; brick-laying, 478; building-trades, 6,060; clothing, 1,728; cooperage, 484; food preparations, 1,419; furniture, 491; lumber, 395; metals and metallic goods, 1,595; mining, 2,060; stone, 468; tobacco, 2,959; transportation, 1,478. These represent 89.35 per cent of the whole number subjected to strikes. In lockouts, five trades bore 80 per cent of the whole burden, as follows: Boots and shoes, 155 establishments; building trades, 531; clothing, 773; metals and metallic goods, 76, and tobacco, 226, or a total of 1,761.

Beside completing the field-work for this report and the compilation of the information, the Bureau has carried on almost to completion the investigation begun last year concerning the moral, physical and economical conditions of the workingwomen of great cities, and has continued its investigation into the cost of the distribution of great staple products. It has also undertaken, according to Congressional instruction, the collection of statistics of marriage and divorce in the United States, a report of which may be submitted before the close of the present session of Congress.

COMMUNICATIONS.

THE BEARING-POWER OF PILES.

Clay Center, Kansas, Dec. 27, 1887.

To the Editors of the American Architect: —

Dear Sirs, — In your issue of Dec. 3, 1887, you speak about a paper on the bearing-power of piling, read by Mr. Ira O. Baker before the Western Society of Civil Engineers and published in the Journal of the *Association of Engineering Societies*. I have lost the address of the Journal named. Would you please give me the address and number containing the above article.

Respectfully yours, Henry S. Maddock.

[We do not know. Our article was suggested by a reprint of the paper in a pamphlet, which, we fear, has found its way to the waste-basket. — Eds. American Architect.]

A QUESTION OF EXTRAS.

Ashland, Wis., January 7, 1888.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly advise me what is customary in the East in settlement of the following bill of extras. After the contract is let, client orders a system of indirect steam-heating to be used in the building, this necessitates the building of 54 flues 8″ x 8″ square 16′ 4″ high in the centre brick wall, the flues being put in at the time the wall was built. The contractor completes the flues according to orders, and brings in a bill for $75 for extra work. Client demurs and refers bill back to architect for adjustment. Would the amount of bricks saved be taken into account in settlement with contractor. I have a very decided opinion regarding the matter, but would like your advice before giving it. Hoping this may be of common interest to more than one young man,

I remain yours respectfully, H.

[It is customary to consider the saving of bricks in the flues as offset by the extra trouble of forming the flues properly, so that under ordinary circumstances there would be no difference in cost between a solid wall and one containing flues. In this case, however, there may have been special difficulty in arranging so many flues, or the contractor may have been put to some extra personal trouble by the change, for which, of course, he is entitled to be paid. — Eds. American Architect.]

NOTES AND CLIPPINGS.

The Spanish National Theatre, Madrid. — An historical playhouse is soon to disappear from Madrid. The Spanish National Theatre, which is over 300 years old, is unsafe through age, and must be pulled down to make place for a new building, with all modern improvements. It was originally built by the monks for the performance of miracle plays, and afterwards housed an Italian pantomime troupe. The performances took place in the day, as the so-called theatre was only a walled enclosure where the spectators stood promiscuously in a paved court-yard. When Philip IV succeeded, early in the seventeenth century, a regular theatre was built, where boxes or raised seats were assigned by royal order to distinguished personages, and an entrance fee of three duros was charged. The masterpieces of Calderon and Lope de Vega were produced on this stage. — *N. Y. Evening Post.*

The Population of China. — The authorities of Pekin have recently taken a census of the Empire, and as it was for taxing purposes the proneness to disbelieve in the large estimates must be modified accordingly. The figures returned by the village bailiffs make the population 319,383,500, which together with the estimates of five provinces omitted makes the aggregate about 392,000,000. These figures are independent of the population of Corea, Thibet and Kashgar. As the population of India exceeds 250,000,000 the Hindoos and Chinese constitute more than half the entire human race. — *London Times.*

TRADE SURVEYS.

The anthracite coal-strike is causing some inconvenience to manufacturers throughout the East, and threatening a great deal more. So far the blast-furnaces in the anthracite coal-fields are receiving a liberal supply of coke, and expect to continue in operation with this fuel until the strike is settled. The rolling-mills are all running as usual on bituminous coal, the supply of which is not affected at present by the strike. Pig-iron remains nominally unchanged, although some companies which are pretty well sold up have nominally advanced prices 50 cents per ton. There are no stocks to speak of, consumption having kept pretty close track on production. Standard No. 1 is $21–$22; standard No. 2, $18–$19; standard forge, $17–$18. The pig-iron makers do not feel in the least concerned over the situation, and naturally apprehend a little stiffening of prices. There is, of course, a possibility that demand may slightly fall off because of the inability of buyers to pay more money to fill old contracts taken before the present situation of affairs. Several inquiries have been made for Southern pig-iron, and no matter which way things go, an increasing demand for Alabama irons is generally anticipated this season. Coke sells at $5 at furnace, and heavy contracts have been placed within the past few days. Bituminous coal is also in active demand. Iron and steel making will go on as usual unless the supply of coke and soft coal should give out. There is fear, of course, that the Wyoming anthracite region, now in, may come out, and that the Clearfield region, now at work, may seize this opportunity to strike for the contested Columbus scale, and that the Connellsville coke-makers may take another rest, but the manufacturing interests are hoping to escape all these threatened evils through the acceptance by the Reading Company of arbitration, a measure which, it must be said, is particularly offensive to them. The bar, plate, sheet and all other iron-mills throughout New York and Pennsylvania are at work with fair orders and good prospects for the winter. An immense consumption of iron will take place this year. Locomotive-building was 25 per cent greater in 1887 than 1886, and car building was nearly one hundred per cent greater. This activity may not be repeated this year, but we do not apprehend much of a falling off. Steel-rails are quoted firm at $32 at mill. Very few orders are arriving. Buyers want supplies for next year at $30 and $31. Wages have been quite generally reduced, and buyers think this reduction ought to allow a little reduction in prices. We have been heavy buyers of foreign material for a year, and our dependence is not at end, although just now very little foreign business is being done on account of the upward tendency of prices abroad. A great deal of railroad-building will be done despite the pessamistic assertions to the contrary. The general trade outlook is good, and we feel certain that we will have an excellent year. Tariff discussions do not create as much unrest as might be supposed. The industries have had timely notice, and they are preparing to defend themselves. The heavy distribution of lumber which was kept up since May 1 until the close of the season will probably be renewed early in the spring. Much as may be said against the wisdom of prosecuting railway construction upon a large scale, the building of railroads will continue to absorb an enormous amount of capital, iron, steel, lumber and building material. Nothing but a sweeping panic can check enterprise, and prevent the building of cities and towns, the opening of mines, and the building of manufactories large and small all over the country. The impulse has been given, and newspaper-writing cannot check it. The fact that the volume of money is steadily increasing, and that there is confidence in our monetary system and that the people at large have confidence in the permanency of healthy-trade conditions all go to strengthen the belief that the business for 1888 will be, if not larger than last year, at least as large in the aggregate. In some directions there will be no doubt a falling off. In other directions there will be an expansion. Averaging the probabilities we may safely say, fully as much money will be expended this year as last, and enterprise will have as many inviting opportunities open to it. It may be too soon to say that labor will not be troublesome, and especially in view of recent disturbances in Pennsylvania and elsewhere, but if the instances which could be specified were examined into, it would be found that there are special causes at work to aggregate labor and make it apparently despotic for the time being. Taking labor all through there is a stronger conservative feeling than ever, and a clearer comprehension of the underlying intimate relationship between employers and employed. The prospects for the early spring trade are certainly favorable. Farm-products have a higher range of values. The lumber dealers throughout the country are holding their present supplies of lumber for higher prices. The lumber manufacturers in the Northwest and South are preparing to so act that they will not check the healthful influence at work. In regard to lumber itself, there will be a much heavier demand for hard-wood, and manufacturers are already preparing for it. A large amount of oak is being taken out and prepared for the mill. It is considered in lumber-trade circles there is no probability of an over-supply of oak on account of the heavy demands from furniture manufacturers, car-builders and general consumers. Walnut has perhaps seen its best days in the East, but the demand throughout the West will absorb all the surplus stocks, if there are any, and leave prices at their high notch. There is a great deal of inquiry for cherry, mahogany, poplar and ash, and the probabilities are that these woods will hold their own without any difficulty. Cypress is also coming in for a variety of purposes, as well as North Carolina sap. Yellow-pine will crowd its way farther to the front against competitors. From reports received from brick manufacturers in different parts of the country it is impossible to form an intelligible opinion as to the probable course of prices. Brick-makers insist upon and will receive higher prices. They are making ample preparations for an increasing supply, and the manufacturers of brick-machinery are also receiving orders for additional machinery and are filling extensive orders, so that so far as these indications go, it would seem the supply of brick will be equal to all demands.

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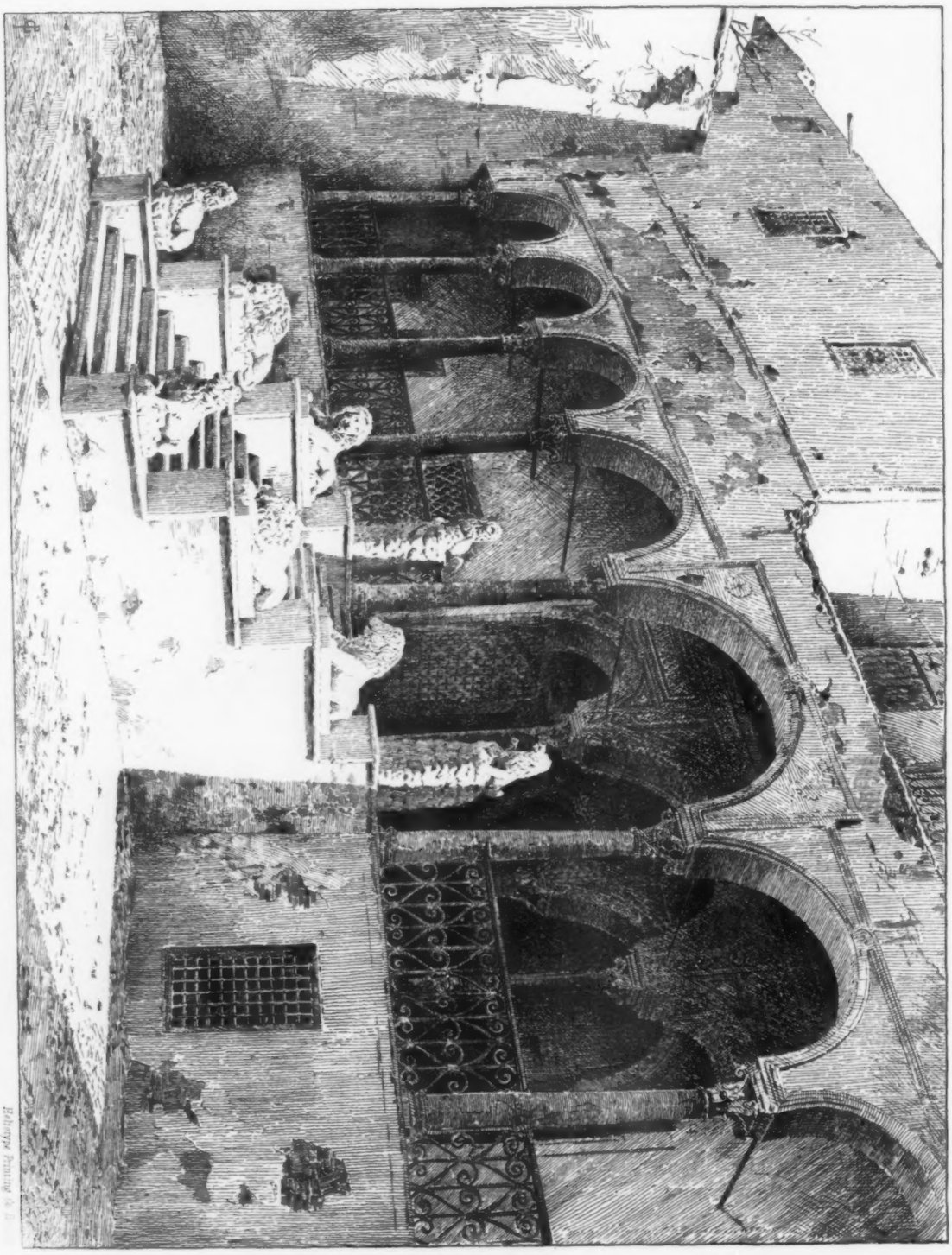

· Interior of the "Bardo" at Tunis ·

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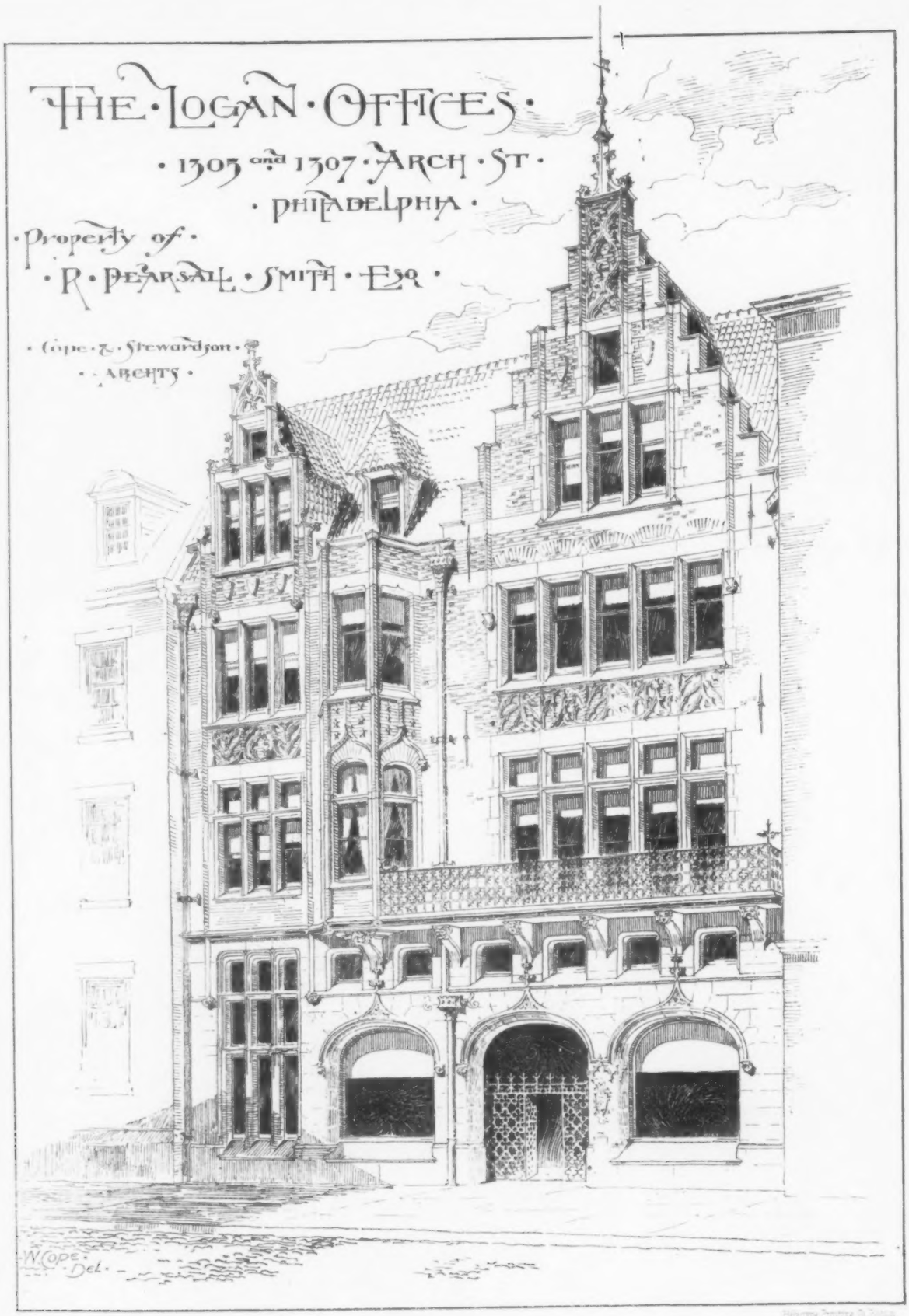

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